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Review of the genus *Venusia* Curtis, 1938 (Lepidoptera: Geometridae: Larentiinae) from Xizang, China

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Abstract: Based on the identification of specimens of the genus *Venusia* (Larentiinae) collected from Xizang, a total of seven species were recognized, including one newly recorded species in Xizang: *Venusia crassisigna* Inoue, 1987, with the remaining 6 being known species in the region. In this paper, the morphological characteristics of adults and the genitalia of *Venusia crassisigna* are described in detail, and images of adults and corresponding genitalia of these 7 species, as well as their distributuio information at home and abroad, are provided. All examined specimens are deposited in the Institute of Plateau Ecology, Xizang Agricultural and Animal Husbandry University.

Keywords: genitalia, new record species, taxonomy, *Venusia*

西藏维尺蛾属（鳞翅目：尺蛾科：花尺蛾亚科）记述

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摘要：通过鉴定采自西藏地区花尺蛾亚科维尺蛾属，共整理出 7 个物种，其中包含 1 个西藏新记录种：*Venusia crassisigna* Inoue, 1987，其余 6 种为该地区已知物种。本文对 *Venusia crassisigna* 的成虫形态特征及外生殖器特征进行了详细描述，并提供了这 7 个物种的成虫与对应外生殖器的形态图，以及其国内外地理分布信息。所有检视标本均保存于西藏农牧大学高原生态研究所。

关键词：外生殖器，新记录种，分类，维尺蛾属

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Introduction

The Larentiinae belongs to small to medium-sized moths, with forewings mostly in yellowish-brown to grayish-brown colors, while the hindwings are relatively pale. The forewings are often adorned with multiple transverse or longitudinal wavy lines; in some species, these transverse wavy lines converge into special patterns such as blocks, spots, or bands. Typically, the forewings possess 1 to 2 accessory cells. For the hindwings, the Sc+R_1 vein is usually connected to the Rs vein and only separates when exceeding half the length of the discal cell; the M_2 vein is quite complete. In many species of this subfamily, the hindwings of males are degenerated and considerably small. The Chinese common name "Hua Chi E Ya Ke [花尺蛾亚科]" (Larentiinae) is derived from their prominent flower-visiting behavior in the adult stage, as well as the feeding habit of larvae of many species that feed on plant flowers (Xue & Zhu 1999; Wang 1997).

Currently, over 6,200 species have been described worldwide (Scoble & Hausmann 2007; Hausmann & Viidalepp 2012). Fauna Sinica has recorded approximately 130 genera, 715 species, and 168 subspecies of Larentiinae in China, which served as a comprehensive summary of the systematic taxonomy research on Chinese Larentiinae at that stage. With the passage of time and the deepening of research, numerous scholars have conducted long-term specimen collection, observation, and taxonomic exploration, leading to the continuous discovery of many new record species and new species.

The genus *Venusia* was established by Curtis in 1839, with *Venusia cambrica* Curtis, 1839 (United Kingdom) designated as the type species. It includes a subgenus *Discoloxia*, which was established by Warren in 1895, with *Cidaria obliquisigna* Moore, 1888 (Darjeeling, India) as the type species. Based on differences in forewing venation and antennae, these two taxa were regarded as distinct genera in European literature, but they were synonymized into a single genus in 2002. Xue & Scoble (2002) recorded 42 known species of *Venusia*, mainly distributed in China and India, among which 29 species were documented in *Fauna Sinica*. Sugden (1966) described three species, namely *V. cambrica*, *V. pearsalli* (Dyar, 1906), and *V. doudecemlineata* (Packard, 1873), and recorded their distribution in British Columbia and associated host plants. Heitzman & Ennis (1978) documented Larentiinae species in the Missouri region and illustrated the male genitalia of *V. comptaria* (Walker, 1860) for the first time. Haruta (1994, 1995) recorded six species in the butterfly and moth atlas of Nepal, including two new species: *V. dilecra* Yazaki, 1995 and *V. roseicostata* Yazaki, 1994. Choi (2002), he described another new species of this genus, *V. megaspilata* (Warren, 1895), providing a detailed morphological description along with photographs of adults and genitalia. Moya (2023) provided new distribution data of *V. bloomeri* (Curtis, 1832*)* and *V. cambrica* (Curtis, 1839) in Spain.

Venusia is similar to *Hydrelia*, but differs in that the male antennae of *Venusia* are sometimes bipectinate, while those of *Hydrelia* are filiform. The unique climatic conditions, vegetation communities, and insect fauna of Xizang support a relatively rich distribution of *Venusia* species. In addition to the seven species described in this study, *V. punctiuncula* Prout, 1839, *V. balausta* Xue, 1999, *V. encosma* (Prout, 1914), *V. naparia* (Oberthur, 1893), *V. tchraria* (Oberthur, 1893), and *V. planicaput* Inoue, 1987 are also distributed in Xizang.

Materials and Methods

All examined specimens are deposited in the Insect Collection of the Institute of Plateau Ecology, Xizang Agricultural and Animal Husbandry University.

First, adult specimens were photographed using a Canon 5D4 camera before dissection. Subsequently, the abdomen of each adult moth was removed with tweezers and placed in a test tube, which was then filled with 10%–15% KOH solution to submerge the abdomen. A beaker was filled with water, and the test tube containing the abdomen was placed inside the beaker; the assembly was heated on a small electric stove for 10–20 minutes. After heating, the abdomen was taken out and rinsed twice. Dissection was performed under a binocular stereomicroscope (LEICA EZ4 HD/S9i) in a petri dish filled with 30% ethanol. The dissected genitalia were dehydrated sequentially

in 30%, 50%, 75%, and 100% ethanol. Thereafter, the genitalia were placed in 100% ethanol and photographed using a LEICA S9i stereomicroscope, and finally preserved in centrifuge tubes containing glycerol. All photographs of adults and genitalia were processed using Adobe Photoshop 2023.

Checklist of the Genus *Venusia* from China

V. cambrica Curtis, 1839
V. punctiuncula Prout, 1938
V. balausta Xue, 1999
V. laria laria Oberthür, 1893
V. marmoraria (Leech,1897)
V. obliquisigna (Moore, 1888)
V. blomeri (Curtis, 1832)
V. szechuanensis Wehrli,1931
V. nigrifurca (Prout, 1927)
V. lilacina (Warren, 1893)
subsp. *lilacina* (Warren, 1893)
subsp. *melanogramma* Wehrli, 1931
V. sikkimensis (Elwes, 1893)
V. violettaria Wehrli, 1931
subsp. *violettaria* Wehrli, 1931
subsp. *kukunoora* Wehrli, 1931
V. eucosma (Prout, 1914)
V. maniata Xue, 1999
V. kioudjrouaria Oberthür, 1893
V naparia Oberthür, 1893
V. tchraria Oberthür, 1893
V. conisaria conisaria Hampson, 1903
V. planicaput Inoue, 1987
V. scitula Xue, 1999
V. paradoxa Xue, 1999
V. biangulata (Sterneck, 1928)
V. apicistrigaria (Djakonov, 1936)
V. accentuata (Prout, 1914)
V. crassisigna Inoue, 1987
V. inefficax (Prout, 1938)
V. lineata Wileman, 1916
V. ochrota Hampson, 1903
=*V. roseicosta* Yazaki, 1994
V. syngenes Wehrli, 1931

Key to the species of genus *Venusia* from Xizang

1. Median portion of forewing postmedial line conspicuously projecting; a large orange-yellow to yellowish-brown patch present from outer side of this line to apex; patch occasionally dull-colored or partially reduced, but always distinguishable; remaining area of forewing grayish-white to light gray **2**
Median portion of forewing postmedial line nearly straight or slightly projecting; no such yellow patch on outer side; if orange-yellowish coloration occurs in this region, remaining area of forewing not grayish-white or light gray **3**

2. Median area of forewing white ..... ***V. obliquisigna***
Median area of forewing light gray ..... ***V. laria laria***

3. Forewing discal spot black, large and distinct ..... ***V. conisaria***
Forewing without discal spot, or discal spot extremely small and indistinct **4**

4. Forewing postmedial line almost straight, without obvious median outward projection **5**
Median portion of forewing postmedial line distinctly outwardly projecting **6**

5. Forewing light yellowish-brown; ♂ valva costa strongly convex outward at median portion ..... *V. sikkimensis*
Forewing light grayish-brown; ♀ signum in median portion of corpus bursae slender and spinose ..... ***V. violettaria violettaria***

6. Dark brown band extending from costa to Cu_1 on outer side of forewing postmedial line ..... ***V. crassisigna***
Entire area from costa to termen on outer side of forewing postmedial line pale-colored, lacking dark band

..... *V. lilacina lilacina*

Taxonomy

Venusia obliquisigna (Moore, 1888)

Examined specimens: 1♂, Hanmi, Medog, Xizang, 22-VII-2013, collected by Zhaohui Pan; 1♂, 80K, Medog, Xizang, 8-V-2017, collected by Zhaohui Pan.

Diagnosis. Adults (Fig. 1). This species is similar to *V. laria* in body color, but can be identified by the following characteristics: the discal spot of the adult forewing extends from the costal margin to the base of M_3; the lower part of the outer line is almost indistinct; the outer line of the hindwing protrudes sharply; the apex of the male valva forms a small hook. **Male genitalia** (Fig. 9): Tegumen relatively long, narrow and slender. Gnathos processes thin and weak; juxta short, broad and sclerotized, lamellar. Saccus broad, semi-elliptical. Valvae particularly long and narrow; valva long, with an arched protuberance at the middle; apical process thick, angular. Aedeagus slender; vesica with a thin, weak lamellar microspine.

Distribution: China (Xizang); Nepal; Sikkim.

Venusia laria laria Oberthur,1893

Examined specimens: 2♂, West Slope of Sejila Mountain, Linzhi, Xizang, 3330 m, 20-VI-2020, collected by Enyong Chen.

Diagnosis. Adults (Fig. 2). This species is similar to *V. obliquisigna*, but can be distinguished by the following characteristics: the discal spot of the adult is a short spot; the triple wavy outer lines form a band-like structure; the valvae are slightly wider than those of *V. obliquisigna*; and the apical process of the valva is extremely sharp. **Male genitalia** (Fig. 10): Tegumen relatively narrow. Juxta long and strip-shaped, bifurcated at the apex. Saccus broad. Valvae relatively slender and long, apex fusiform; dorsal part of valva slightly protuberant at the upper-middle section; apical process of valva a sharp and slender angular process. Aedeagus slender, without cornuti.

Distribution: China (Fujian, Sichuan, Yunnan, Xizang).

Venusia conisaria Hampson, 1903

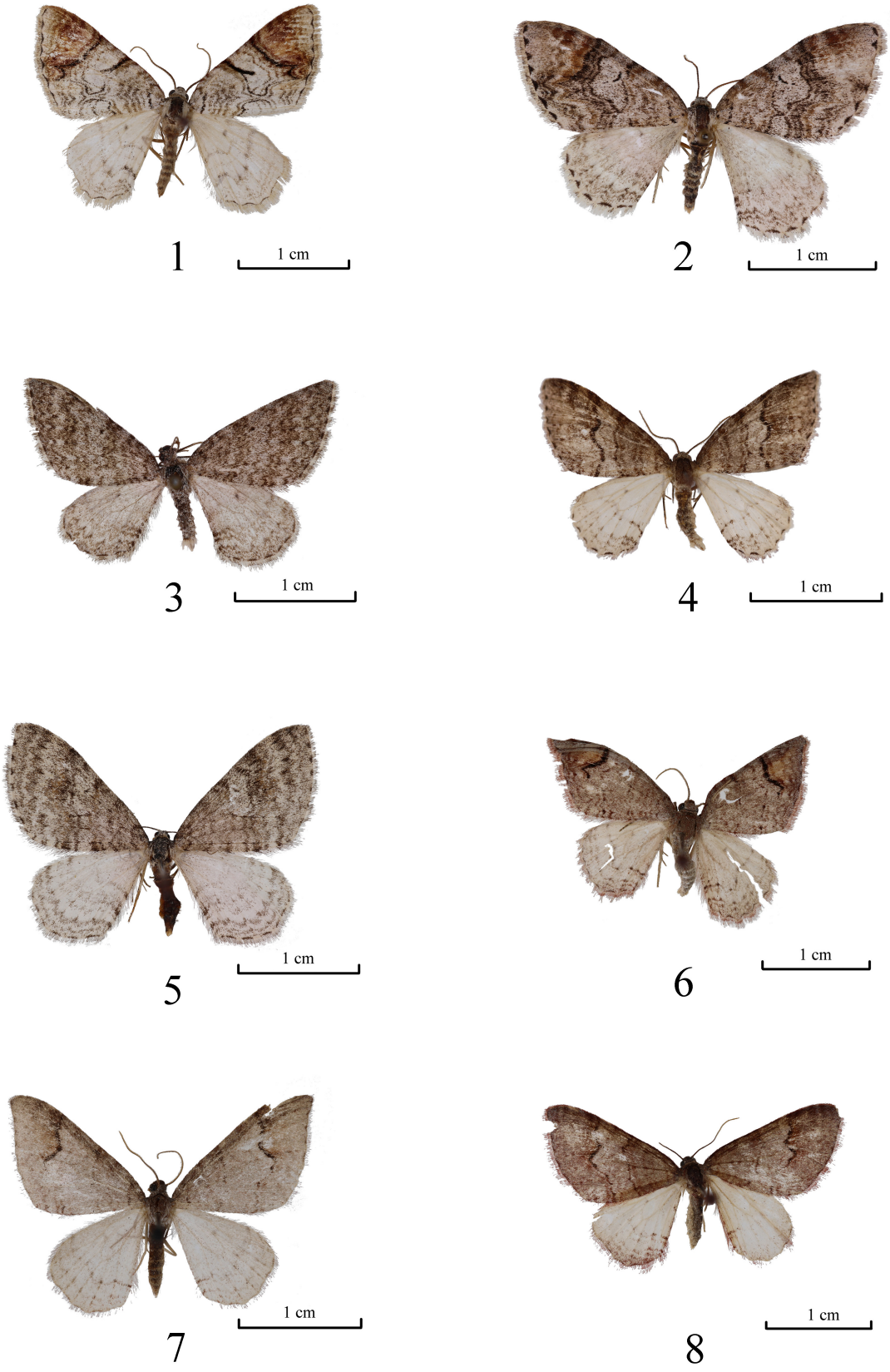
Examined specimens: 1♂, Sejila Mountain, Linzhi, Xizang, 4040 m, 5-VI-2017, collected by Zhaohui Pan.

Diagnosis. Adults (Fig. 3). This species can be distinguished from other congeners by the distal half of the male valva curving toward the valva costa, forming a curved bean pod-like shape. **Male genitalia** (Fig. 11): Uncus reduced to a small lamella; tegumen small; saccus broad and semicircular. Gnathos processes fused with tegumen at the base of valva costa, slender and elongated, with numerous small setal tufts. Juxta narrow and long, lamellar. Valva gradually tapering from base to apex, forming an angular apical process. Valva broad, with rounded apex curved toward valva costa. Aedeagus slender, slightly curved at the middle; vesica smooth, without cornuti.

Distribution: China (Xizang); Nepal; Sikkim; Kashmir.

Venusia sikkimensis (Elwes, 1893)

Examined specimens: 1♂, Jilong Checkpoint, 15-VII-2025, collected by Zhaohui Pan, Biao Zhao, Shuang Yang, Xinhui Yang; 1♂, East Slope of Sejila Mountain, Linzhi City, 4090 m, 21-VII-2020, collected by Chunlan Xian.



FIGURES 1–8. Adults: **1** ♂, *V. obliquisigna* (Moore, 1888) **2** ♂, *V. laria laria* Oberthur,1893 **3** ♂, *V. conisaria* Hampson,1903 **4** ♂, *V. sikkimensis* (Elwes, 1893) **5** ♀, *V. violettaria violettaria* Wehrli, 1931 **6** ♂, *V. crassisigna* Inoue, 1987 **7–8** ♂, ♀ *V. lilacina lilacina* (Warren, 1893).

Diagnosis. Adults (Fig. 4). This species has forewings mostly in yellowish-brown to brown color, relatively dark, with an obvious light-colored median band. The male genitalia are similar to those of *V. laria laria*, but can be distinguished by the rounded and non-protruding valva apex and the extremely slender aedeagus. **Male genitalia** (Fig. 12): Uncus reduced to a lamella. Tegumen short and broad. Gnathos processes combined with juxta on the dorsal surface of tegumen. Juxta long, with shallow bifurcation at the upper end and lateral lobes protruding at both ends of the lower end. Saccus short and broad. Valvae relatively broad; valva apex rounded; valva convex in the middle; apical process of valva long and sharp; dorsal part of valva convex at the upper-middle part. Aedeagus extremely long, longer than valvae; vesica with an area composed of tiny spines.

Distribution: China (Xizang); Nepal; Sikkim.

Venusia violettaria violettaria Wehrli, 1931

Examined specimens: 2♀, East Slope of Sejila Mountain, Linzhi, 4500 m, 21-VI-2020, collected by Chunlan Xian; 1♀, West Slope of Sejila Mountain, Linzhi, 4160 m, 20 June 2020, collected by Zhaohui Pan; 1♀, Sejila Mountain, Linzhi, 4040 m, 1-VIII-2013, collected by Zhaohui Pan.

Diagnosis. Adults (Fig. 5). This species is similar to *V. kioudjrouaria*, but can be distinguished by the smaller lamella antevaginalis and corpus bursae of the female genitalia, with a smaller distribution area of the signa. **Female genitalia** (Fig. 15): Anal papillae large. Anterior and posterior apophyses slender and long. Lamella antevaginalis sclerotized into a cup shape, with a small pointed structure at the anterior end of the sclerotized part. Ductus bursae a short and broad sclerotized ring. Corpus bursae rounded, small, with two signa: the ones near the bursa neck are irregular and small, and the ones in the middle of the corpus bursae are slender, all composed of fine spines.

Distribution: China (Xizang, Sichuan).

Venusia crassisigna Inoue, 1987 (Newly recorded for Xizang)

Examined specimens: 1♂, Duoxiongla Tunnel, Hanmi, Medog, 20-VII-2021, collected by Zhaohui Pan, Xinrui Jiang, Le Chen.

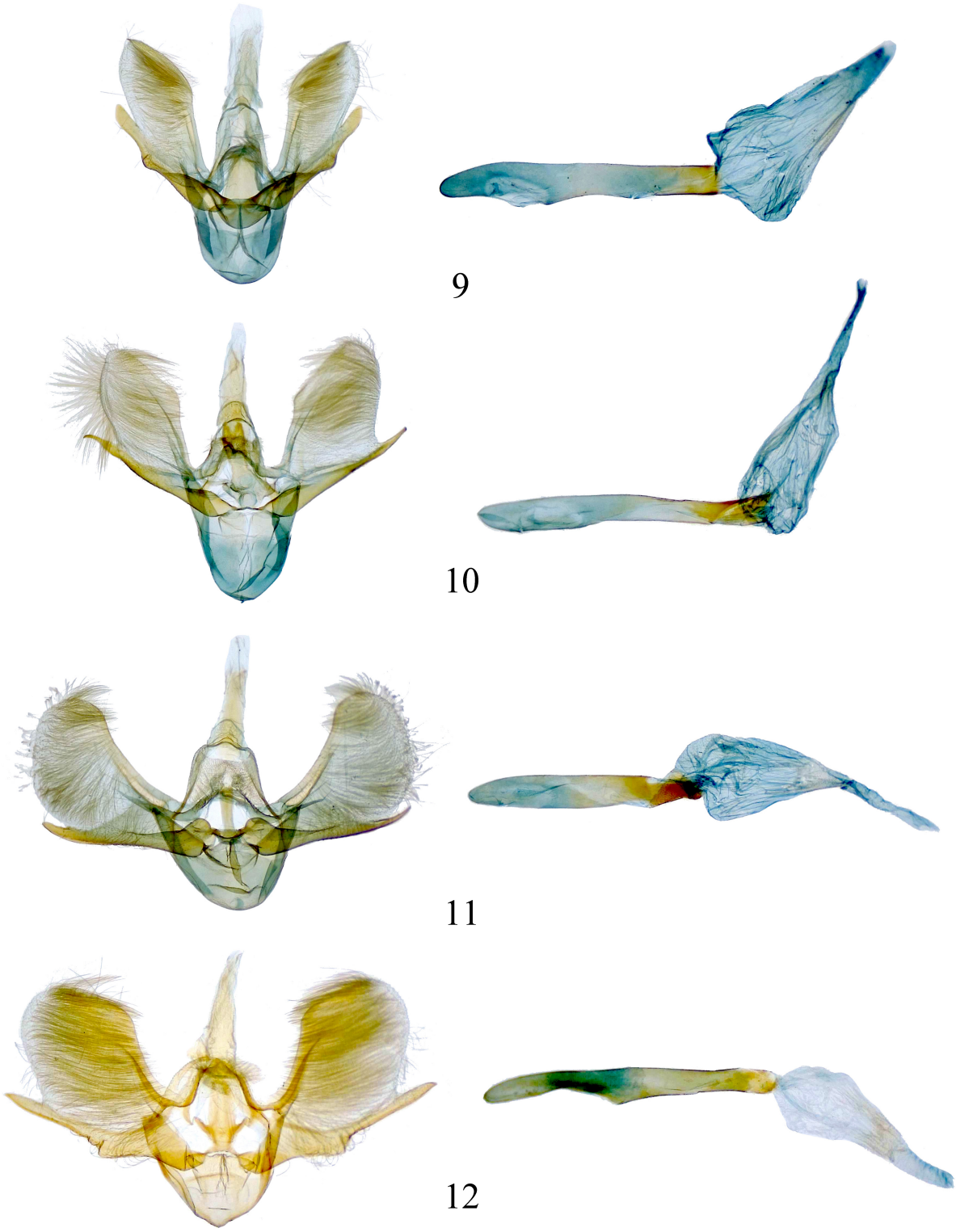
Description of male adult (Fig. 6): Forewing length 24 mm. Frons brown; vertex and dorsal surface of thorax dark reddish-brown, mixed with a small amount of gray. Dorsal surface of abdomen reddish-brown mixed with grayish-white; anal tuft light brown; ventral surface of abdomen light brown. Forewings dark reddish-brown with dark reddish-brown striae. Subbasal line and inner line indistinct. Median line extremely obscure, almost invisible. Discal spot indistinct. Outer line double: from the costal margin to Cu_1, it is extremely thick and dark reddish-brown, protruding into a sharp tooth between M_3-Cu_1, then gradually becoming indistinct; the inner outer line is thin and weak. Adjacent to the outer side of the outer line is a companion line equally thick, with quite bright color. A large bright reddish-brown patch is present on the outer side of the outer line near the apex. Marginal line discontinuous, dark reddish-brown, wavy. Fringe abundant and bright in color. Hindwings light grayish-brown. Discal spot gray, inconspicuous. Outer line blackish-gray, wavy, protuberant between M_3-Cu_2. Submarginal line 2–3 uneven blackish-gray lines. Marginal line and fringe the same as those of forewings.

Male genitalia (Fig. 13): Tegumen and saccus short and small. Juxta forked at the upper end, with both sides of the lower end protruding upward and obliquely. Valvae relatively broad; valva slightly folded in the middle, apical process sharp-toothed; dorsal part of valva convex in the middle. Aedeagus moderately thick but relatively long, longer than valvae; vesica with lamellar tiny spines.

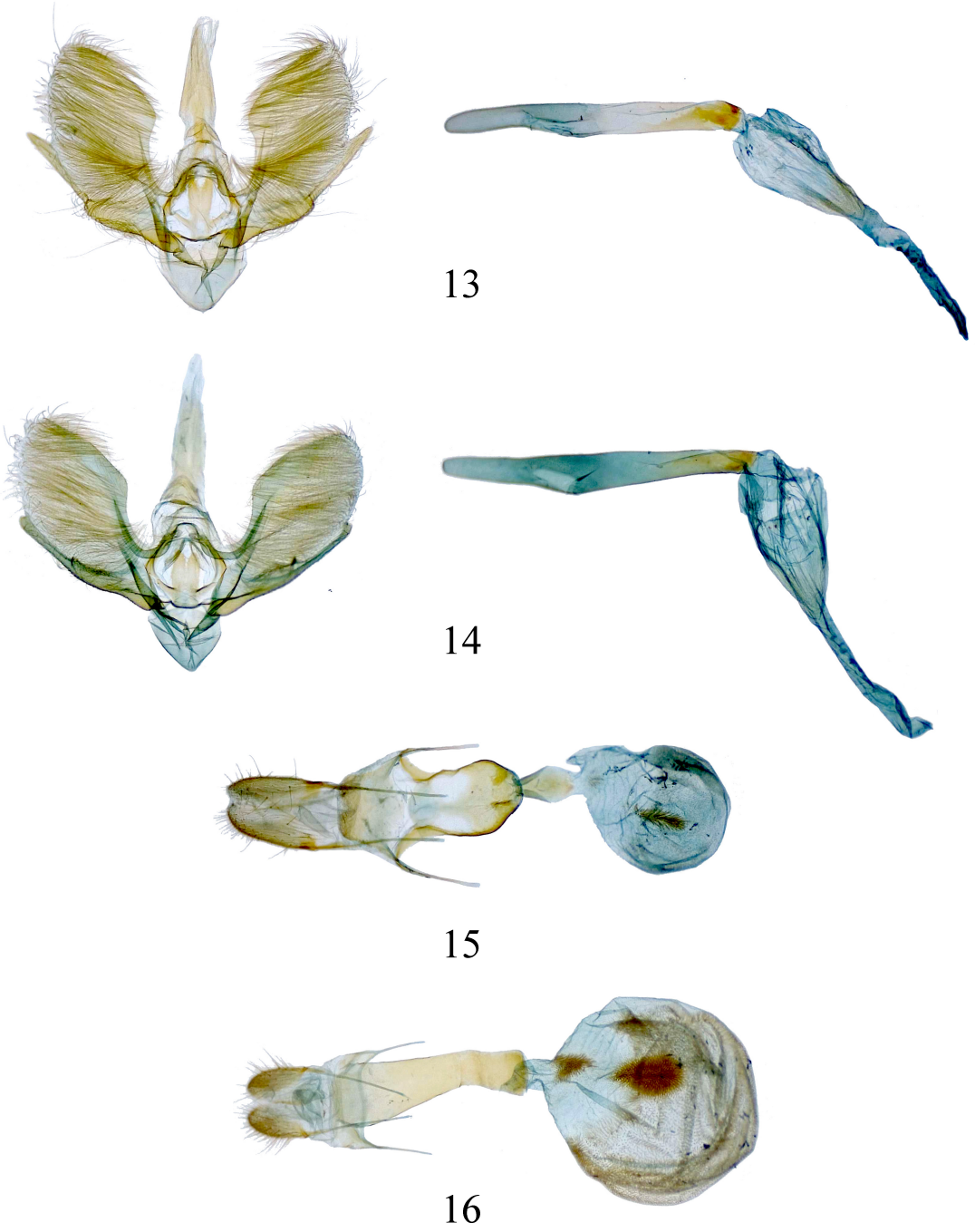
Diagnosis: This species is similar to *V. lilacina lilacina*, but can be distinguished by the following characteristics: the outer line is relatively thick and gradually disappears after Cu_1, and there is a thin and weak companion line adjacent to the inner side of the outer line. Their male genitalia are also very similar, but the juxta of *V. crassisigna* is wider, and the apical process of the valva extends into a sharp tooth. The male genitalia of this

species are extremely similar to those of *V. scitula* recorded in Xue (1999), but the forewing color of this species is darker.

Distribution: China (Xizang); Nepal.



FIGURES 9–12. Male genitalia: **9** *V. obliquisigna* (Moore, 1888) **10** *V. laria laria* Oberthur,1893 **11** *V. conisaria* Hampson,1903 **12** *V. sikkimensis* (Elwes, 1893).



FIGURES 13–16. 13–14 Male genitalia **15–16** Famale genitalia **13** *V. crassisigna* Inoue, 1987 **14** *V. lilacina lilacina* (Warren, 1893) **15** *V. violettaria violettaria* Wehrli, 1931 **16** *V. lilacina lilacina* (Warren, 1893).

Venusia lilacina lilacina (Warren,1893)

Examined specimens: 1♂, West Slope of Sejila Mountain, Linzhi, Xizang, 3780 m, 18-VII-2020, collected by Chunlan Xian; 1♂, 80K, Medog, Xizang, 1-VIII-2014, collected by Zhaohui Pan; 1♀, Duoxiongla Tunnel, Hanmi, Medog, Xizang, 20-VII-2017, collected by Zhaohui Pan.

Diagnosis. Adults (Figs 7–8). This species is similar to *V. crassisigna* in body color, but can be distinguished from the latter by the slender outer line and differences in male genitalia. **Male genitalia** (Fig. 14): Tegumen narrow

and small. Gnathos processes extremely thin and weak, fused with tegumen at the base of valva costa. Juxta shallowly forked at the upper end, with small triangular projections on both sides of the lower end that extend upward and obliquely. Saccus small, nearly triangular. Valvae slightly long and narrow; valva slightly concave in the middle, apical process very short and blunt; dorsal part of valva protruded in the middle with a deep curve.

Female genitalia (Fig. 16): Apophyses moderately slender. Ductus bursae extremely long and sclerotized; the membrane at the bursa neck has a distinct boundary with the bursa neck. Corpus bursae rounded, with a large number of microspines scattered on the surface. Two signa present: the one near the bursa neck is small and irregular, while the one in the middle of the corpus bursae is larger and approximately drop-shaped, both composed of fine spines.

Distribution: China (Xizang); Nepal; Sikkim.

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Additional information

Author contributions: Conceptualization: S Yang. Resources: Z-H Pan. Supervision: Z-H Pan. Visualization: S Yang & Z-H Pan. Writing - Original Draft: S Yang. Writing - Review & Editing: Z-H Pan.

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Ethical statement: No ethical statement was reported.

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